

**What is claimed is:**

- 1 1. A method for satellite communications, comprising:  
2 measuring a satellite drift in the north/south direction at an earth station;  
3 generating a history of the measured drift over a period of time; and  
4 generating flywheel timing values based on delay values predicted according to the  
5 measured satellite drift history over a predetermined time.
- 1 2. A method as claimed in claim 1, wherein the predetermined period of time is one  
2 sidereal day.
- 1 3. A method as claimed in claim 1, wherein the generated flywheel timing values are  
2 used in a time division multiple access (TDMA) satellite communications system.
- 1 4. A method as claimed in claim 1, further comprising continuously generating, based on  
2 the generated flywheel timing values, at least one of receive and transmit TDMA timings at a  
3 traffic terminal, receive TDMA timing at a reference terminal, and TDMA timing when a  
4 receive reference burst is lost.
- 1 5. A method as claimed in claim 1, wherein the generating comprises predicting delay  
2 values used for at least one of transmit timing, receive timing, and reference pulse timing.
- 1 6. A method as claimed in claim 5, wherein the earth station is one of a traffic terminal  
2 and a reference terminal.
- 1 7. A method as claimed in claim 1, wherein the flywheel timing values, for a TDMA  
2 satellite communications system having a traffic terminal and a reference terminal, are  
3 generated by calculating a number of symbols with respect to reference pulse timing of the  
4 traffic terminal.

- 1 8. A method as claimed in claim 7, further comprising, during normal operation, the  
2 reference terminal transmitting correction information to the traffic terminal.
- 1 9. A method as claimed in claim 8, wherein the correction information comprises a  
2 reference burst used by the traffic terminal to derive a receive timing.
- 1 10. A method as claimed in claim 8, further comprising synchronizing the transmitting by  
2 measuring timing offset of a traffic burst at the reference terminal, and adjusting a burst  
3 transmit timing at the traffic terminal.
- 1 11. A method as claimed in claim 4, wherein the continuous generating of TDMA timing  
2 comprises generating control frame timing based on a calculated start of receive control  
3 frame delay value and a calculated start of transmit control frame delay value.
- 1 12. A method as claimed in claim 11, wherein the delay values are compensated  
2 according to at least one of a range change and a drift of a traffic terminal clock with respect  
3 to a reference terminal clock.
- 1 13. A flywheel timing generation method, comprising:  
2 generating a reference pulse stream with a period of one control frame;  
3 measuring and recording a plurality of receive time delay and transmit time delay  
4 values for a satellite communication signal over a predetermined period of time;  
5 designating, for every control frame interval, start of receive frame delay and start of  
6 transmit frame delay values based on the control frame period and based on the recorded time  
7 delay values, referenced to a designated time;  
8 from a designated value for receive frame delay, generating a flywheel receive start  
9 timing by counting a calculated number of symbols from a corresponding designated  
10 reference pulse;

11 from a designated value for start of transmit frame delay, generating a flywheel  
12 transmit start timing by counting a calculated number of symbols from a corresponding  
13 designated reference pulse.

1 14. A method for satellite communications, comprising:  
2 measuring and recording a plurality of timing delay values at an earth station for a  
3 period of time; and  
4 generating flywheel timing values by calculating a satellite range change based on the  
5 recorded delay values, the range change predicted to compensate a satellite drift in the  
6 north/south direction over a predetermined time.

1 15. A method as claimed in claim 14, wherein the predetermined period of time is one  
2 sidereal day.

1 16. A method as claimed in claim 14, wherein the generated flywheel timing values are  
2 used in a time division multiple access (TDMA) satellite communications system.

1 17. A method as claimed in claim 14, further comprising continuously generating, based  
2 on the generated flywheel timing values, at least one of receive and transmit TDMA timings  
3 at a traffic terminal, receive TDMA timing at a reference terminal, and TDMA timing when a  
4 receive reference burst is lost.

1 18. A method as claimed in claim 14, wherein the generating comprises predicting delay  
2 values used for at least one of transmit timing, receive timing, and reference pulse timing.

1 19. A computer system used for satellite communications, comprising:  
2 a processor; and  
3 a memory including software instructions adapted to enable the computer system to  
4 perform the steps of:

5           generating a reference pulse stream with a period of one control frame;  
6           measuring and recording a plurality of receive time delay and transmit time delay  
7 values for a satellite communication signal over a predetermined period of time;  
8           designating, for every control frame interval, start of receive frame delay and start of  
9 transmit frame delay values based on the control frame period and based on the recorded time  
10 delay values, referenced to a designated time;  
11          from a designated value for receive frame delay, generating a flywheel receive start  
12 timing by counting a calculated number of symbols from a corresponding designated  
13 reference pulse;  
14          from a designated value for start of transmit frame delay, generating a flywheel  
15 transmit start timing by counting a calculated number of symbols from a corresponding  
16 designated reference pulse.

1   20.    A computer system used for satellite communications, comprising:  
2           a processor; and  
3           means for generating flywheel timing values considering the daily inclination change  
4 due to a satellite drift in the north / south direction.

1   21.    A computer system used for satellite communications, comprising:  
2           a processor; and  
3           means for generating flywheel timing values considering a daily delay value change  
4 for received and transmitted signals due to satellite drift in the north / south direction.

1   22.    A computer system as claimed in claim 21, wherein said daily delay value is  
2 computed as a function of a maximum time difference due to the satellite drift in one sidereal  
3 day.

1   23.    A circuit for flywheel operation in a satellite communications system, comprising:

2 a first counter operative to measure a receive delay time during a normal operation,  
3 the first counter operative to receive a predicted receive delay value and generate a flywheel  
4 receive control timing during flywheeling operation;

5 a second counter operative to measure a transmit delay time during a normal  
6 operation, the second counter operative to receive a predicted transmit delay value and  
7 generate a flywheel transmit control timing during flywheeling operation;

8 a first latch operative to record the measured receive delay time; and

9 a second latch operative to record the measured transmit delay time.

1 24. A circuit as claimed in claim 22, further comprising a symbol clock operative to  
2 generate a reference pulse stream.

1 25. A satellite communications system having a satellite, at least one reference terminal,  
2 and a plurality of traffic terminals in communication with the reference terminal for  
3 transferring timing correction information between the terminals, the system comprising:

4 a timing correction signal generator in the satellite for transmitting the timing  
5 correction information to the reference terminal; and

6 a flywheel timing generator operative to generate flywheel timing signals when the  
7 timing correction information transmitted by the satellite is not available to the reference  
8 terminal,

9 wherein the flywheel timing generator generates the flywheel timing signals based on  
10 at least one of a daily inclination change due to a satellite drift in the north / south direction  
11 and a daily delay value change for received and transmitted signals due to satellite drift in the  
12 north / south direction.